219* Lung clearance index: wash-in data compared to wash-out data

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Lung clearance index (LCI) is a sensitive marker of early CF lung disease. It is a non-invasive but time consuming test. When using an inert gas such as Helium or SF6 the wash-in phase is followed by a washout phase. For routine follow up it would be useful if the test duration could be shortened to the wash-in phase only. We therefore compared test acceptability, result variability and correlation (Pearson) when calculating LCI from CEV (cumulative exhaled volume) and FRC obtained during wash-in and washout.

Results: 23 children with CF (age 6–17) were measured by helium multiple breath washout (Exhalyzer D, Eco Medics) and values were compared with %FVC, %FEV1 and %FEF25–75. Measurements did not reach quality control criteria (at least 2 FRC values within 10% of the smallest) in 3 children for wash-in with 4 invalid washout measurements. FRC washout (liter) was smaller ($p = .01$) than FRC wash-in, mean difference was –0.120 (95% CI –0.213, –0.027), but values correlated strongly ($r = 0.97$; $p < 0.001$). Mean intra-patient CV's for FRC washout and wash-in were 2.52 and 3.05. Mean CEV from washout and wash-in did not differ, mean intra-patient CV during for CEV in both phases was <3%, $r = 0.853$ ($p < 0.001$). LCI washout was higher ($p = .05$) than LCI wash-in, respectively 8.95 (sd 1.55) and 8.10 (sd 1.21), $r = 0.62$ ($p = 0.008$). All patients with LCI < 7 (washout or wash-in) had normal %FVC, %FEV1 and %FEF25–75 but not vice versa.

Conclusion: in CF children valid LCI measurements can be calculated from the wash-in phase. They strongly correlate with LCI washout values. Therefore LCI measurement technique can potentially be simplified and shortened.

220* Transition of lung function from infants to children with cystic fibrosis (CF), evaluated by whole-body plethysmography

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We aimed to evaluate the onset of functional characteristics during infancy with follow-up during childhood, as well as to determine the physiological factors of lung function predominantly influencing these mechanisms in relation to genotypes. Lung function was assessed by infant whole-body plethysmography in 66 infants (30 males, 36 females) with CF at ages 6 to 21 months pertaining to functional residual capacity (FRC_{pleth}) and effective airway resistance (sR_{eff}), as well as by whole-body plethysmography and multibreath nitrogen washout during childhood (5 to 14 years of age), featuring FRC_{pleth}, lung clearance index (LCI), trapped gas (V_{TG}), sR_{eff}, and forced expiratory indices (FEV_1, FEF_{50}). Follow-up data expressed as standard deviation scores (SDS), equal to z-scores, were evaluated by linear mixed effects model (LMM) analysis. CF infants, who presented with bronchial obstruction only, demonstrated later in 72.7% ventilation inhomogeneities (LCI > 4SDS), whereas CF infants presenting with pulmonary hyperinflation and bronchial obstruction were prone to develop in addition to ventilation inhomogeneities ($p < 0.001$), trapped gases ($p < 0.001$) and gas exchange disturbances (PaO_2: $p < 0.0001$; $PaCO_2$: $p < 0.001$) later in childhood. In regard to genotypes, F508del(2) and F508del/3905insT presented with the highest progression in pulmonary hyperinflation. Moreover sR_{eff} differentiated significantly between all genotypes ($p < 0.001$), showing the highest progression in patents with F508del/3905insT.

It is **concluded** that functional abnormalities assessed by infant whole-body plethysmography in CF infants are predictive for subsequent functional deficits in later childhood.

221* Validation of the Liverpool Respiratory Symptom Questionnaire (LRSQ) in well children with cystic fibrosis (CF)

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Objectives: To assess whether a respiratory symptom questionnaire [previously validated in a preschool population (LRSQ)] can distinguish between well children with and without CF. Also, to examine whether LRSQ scores correlate with Northern Chest X-ray (NCXR) score, FEV1 and Shwachman (S) score.

Methods: Parents of children with CF and healthy controls completed the LRSQ. Children with CF were well at the time of LRSQ completion. Questions were grouped into 8 domains and scored from "not at all" (0) to "every day" (5). Statistical analysis used Mann–Whitney, Kendall's rank correlation, multiple linear regression (confounders) and Cronbach's alpha (internal consistency). Data expressed as median [IQR].

Results: 104 children with CF had significantly higher total LRSQ scores (17 [6–30]) compared to 182 controls (2 [0–6] $p < 0.001$). Scores were higher in all domains ($p < 0.001$). Domain scores were higher in those children with persistent pseudomonal carriage ($p < 0.05$). There was a positive correlation between total LRSQ score and NCXR score ($p < 0.01$). There were negative correlations between total score and S score ($p < 0.001$) and total score and FEV1 ($p < 0.001$). Cronbach's alpha scores were >0.7 in 7 of 8 domains.

Conclusions: A significantly increased LRSQ score in children with CF, even during a period of good health, compared to non-CF controls further validates this as a robust tool to detect significant respiratory disease in a paediatric population. The finding of significant correlation with other markers of disease severity in older CF children suggests the potential for use of the LRSQ as a clinical tool to monitor respiratory condition.

222 A new simple symptom scoring system for acute pulmonary exacerbations (PExs) in CF patients

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Introduction: Most available symptom scores (SS) and quality-of-life questionnaires are designed for the evaluation of long-term interventions in CF. We describe and validate a simple SS that can be used to evaluate CF acute PExs.

Patients and Methods: Symptoms evaluated were cough, sputum, breathlessness and fatigue based on the MRC respiratory questionnaire. Each symptom was scored from 1 to 4 according to severity, 4 being the worst. Total SS was the summation of the scores of each symptom. SS was evaluated during PExs at the start of IV antibiotic treatment, day 7 and end (day 14). All patients underwent spirometry according to BTS/ARTP standards. Validation of the SS included 4 steps: internal correlation of the components of the SS; sensitivity of the SS to change during treatment; correlation of the total SS with FEV1, PEFR and FVC; and correlation of changes in the total SS with changes in FEV1.

Results: 122 observations in 50 adult CF patients were analysed; mean age 25.7 y. There was significant correlation between the components of the SS, with the exception of cough and breathlessness. The total SS inversely correlated with at least one spirometry value. Breathlessness score inversely correlated with FEV1, FVC and PEFR. Total SS improved at the end of PExs in 84.5% of cases, remained unchanged in 5.3% and worsened in 10.2% of cases. Changes in SS inversely correlated with changes in FEV1 ($r = -0.32$ $P = 0.037$).

Conclusions: This is a new simple SS that evaluates acute PExs in CF patients. The majority of the components of the SS achieved internal correlation. SS was sensitive to change during treatment. A significant correlation was seen between the SS and FEV1.